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# Transient Protection System (TPS) Operation Details

Application Note #6

## ***Overview***

Many types of instrumentation and related electronics are commonly subjected to transients that include lightning, either direct or indirect, power line and electrostatic discharge.

The Transient Protection System engineered and manufactured by Canary Systems offers a reasonable compromise between cost and performance, making it very suitable to protect sensitive instruments and/or electronics from these types of transients.

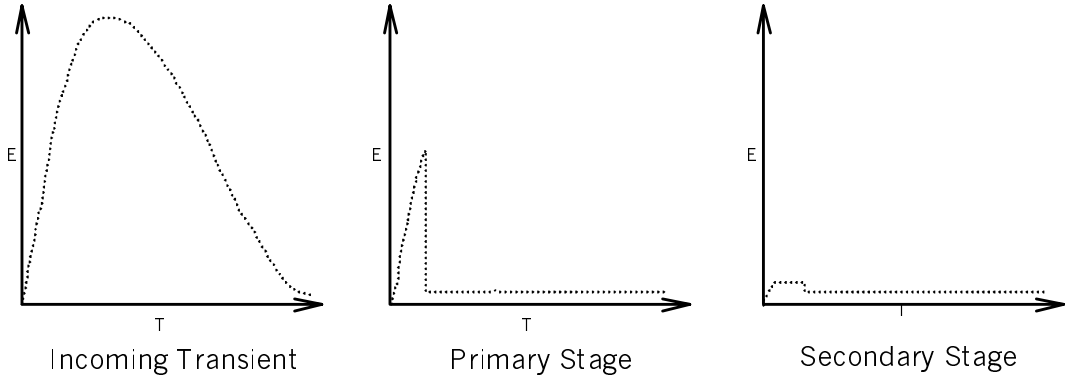
Essentially there are two types of transient protection devices commonly used for these applications, crowbar type devices such as air gaps, plasma surge arrestors or gas discharge tubes, carbon blocks and SCR (silicon controlled rectifier) and clamp type devices such as zener diodes (transzorbs) and MOV's (metal oxide varistors). These devices are essentially characterized as follows, crowbar type devices are slower acting but can handle fairly large energy transients, clamp devices are faster acting but are limited in their energy absorbing capability. Also, clamp type devices typically degrade more rapidly with use than crowbar devices. There are various other lightning protection schemes available, generally involving shielding or arrays of high-energy crowbar and breaker devices but for the most part they are impractical for the instrumentation field.

The ideal protection system for sensitive instruments and electronics utilizes both a crowbar type device and clamp device, commonly referred to as a 2-stage protection system. Isolation is required between stages, this is usually accomplished with an inductor (the Canary Systems TPS utilizes this component) or resistor.

Of course it must be remembered that ***any*** lightning protection scheme works to ***improve the likelihood of survival*** in the event of a high energy transient (as is typical of lightning), however, ***no system can guarantee protection!*** A direct lightning strike will destroy most instrumentation (and related electronics) unless extreme (and high cost) lightning protection schemes have been utilized. Even with high cost lightning protection systems instrumentation is susceptible to destruction due to the electrically sensitive nature of these devices.

## ***TPS Operation Details***

The operation of the Canary Systems TPS is graphically depicted below, where E represents energy, T represents time and the transient is depicted as a dotted line.



Please see Canary Systems Application Note #5 for a more detailed discussion of transients, transient protection devices and systems, and the criteria used to evaluate performance.

## ***Specifications***

*Tripolar Plasma Surge Arrestor (Instrument Leads)*
DC Breakdown Voltage: 200-300 volts (nominal 250 V)
Surge Life: 400 (10/1000 ms pulse @ 500 Amps)
Maximum Surge Current: 10 kA per side (8/20 µs pulse)
Insulation Resistance: >10,000 Megohm
Operating Temperature: -65° to +125° C

*Bipolar Plama Surge Arrestor (Shield Drain Wire)*
DC Breakdown Voltage: 195-265 volts (nominal 230 V)
Surge Life: 1000 (10/1000 ms pulse @ 500 Amps)
Maximum Surge Current: 20 kA (8/20 µs pulse)
Insulation Resistance: >10,000 Megohm
Operating Temperature: -65° to +125° C

*Inductor*
Insulation Breakdown Voltage: 1000 V RMS
Maximum DC Resistance: 0.25 ohm (0.5 ohm for 2 wires)
Operating Temperature: -65° to +130° C

*Normal Mode Transzorbs*
Reverse Standoff Voltage (clamping voltage): 47.8 V
Power Dissipation: 1500 W
Peak Pulse Current (Ipp): 19.5 A
Maximum Clamping Voltage (@ Ipp): 77 V
Operating Temperature: -65° to +165° C

*Common Mode Transzorb*
Reverse Standoff Voltage (clamping voltage): 18.8 V
Power Dissipation: 1500 W
Peak Pulse Current (Ipp): 49 A
Maximum Clamping Voltage (@ Ipp): 30.6 V
Operating Temperature: -65° to +165° C